What Is Claimed Is:

1. A method for measuring the thickness of thin film, comprising the steps of:

irradiating light onto a sample having a composition in which a pattern formed onto the surface thereof is covered by an optically transparent thin film;

detecting the reflected light generated by said sample due to the irradiation of said light, by means of an optical system; and

determining the thickness of said optically transparent film using spectral waveform information for the reflected light thus detected;

wherein surface area ratio information for said pattern within the detection field of view of said optical system is used in the step of determining the thickness of said optically transparent film.

2. The method for measuring the thickness of thin film according to claim 1, wherein the width of the pattern formed on the surface of said sample is 1 μm or a smaller dimension.

3. A method for measuring the thickness of thin film, comprising the steps of:

irradiating light onto a sample in which a plurality of layers of films are formed and the surface thereof is covered by an optically transparent thin film;

detecting the reflected light generated by said sample due to the irradiation of said light, by means of an

optical system; and

determining the thickness of said optically transparent film using spectral waveform information for the reflected light thus detected;

wherein, in the step of determining the thickness of said optically transparent film, regional models having a plurality of layer structures are established, the waveforms of the reflected light from said regional models are calculated, and the thickness of said optically transparent film is determined by fitting, using said calculated waveform information and the spectral waveform information of the detected reflected light.

4. The method for measuring the thickness of thin film according to claim 3, wherein said regional models include regional models in which the reflected light from said pattern is mixed with the reflected light from the layer below said pattern.

5. The method for measuring the thickness of thin film according to claim 3, wherein a plurality of layer structures are established in said regional models, and the regions where these respective structures border each other are established as separate structures.

6. A method for measuring the thickness of thin film, comprising the steps of:

irradiating light onto a sample having a composition in which a pattern formed onto the surface thereof is covered

by an optically transparent thin film;

detecting the reflected light generated by said sample due to the irradiation of said light, by means of an optical system; and

determining the thickness of said optically transparent film using spectral distribution waveform information for the reflected light thus detected;

wherein, in the step of determining the thickness of said optically transparent film, a regional model is established which takes into account a region where the reflected light from said pattern and the reflected light from the layer beneath said pattern are mixed, the waveform of the reflected light from the regional model thus established is calculated, and the thickness of the optically transparent film covering said pattern is determined using the waveform information thus calculated and the spectral waveform information of said detected reflected light.

7. The method for measuring the thickness of thin film according to claim 6, wherein the width of the pattern formed onto the surface of said sample is 1 μm or a smaller dimension.

8. A method for measuring the thickness of thin film, comprising the steps of:

irradiating light onto a wafer surface;

detecting the reflected light from said wafer surface generated by said irradiation of light; and

measuring the film thickness on the basis of the

reflected light thus detected;

wherein, in the step of measuring said film thickness, measurement points are determined using spectral data from said detected reflected light;

9. The method for measuring the thickness of thin film according to claim 8, wherein said measurement points are determined using information relating to the position and size indicating the maximum value or minimum value of the spectral data of said reflected light.

10. The method for measuring the thickness of thin film according to claim 8, wherein frequency analysis of the spectral data of said reflected light is performed and said measurement points are determined on the basis of the results of said frequency analysis.

11. The method for measuring the thickness of thin film according to claim 8, wherein the surface area ratio of the structure to be measured within the measurement field of view is determined from the spectral data of said reflected light, and said measurement points are determined using the surface area ratio information thus determined.

12. An apparatus for measuring the thickness of thin film, comprising:

irradiating means for irradiating light onto a sample having an optically transparent thin film formed onto the surface thereof;

detecting means for detecting the reflected light

generated by said sample due to the irradiation of said light by said irradiating means, by means of an optical system; and

film thickness calculating means for calculating the film thickness from the data detected by said detecting means;

wherein said film thickness calculating means determines the thickness of said optically transparent film by using surface area ratio information for said pattern within the detection field of view of said optical system.

13. The apparatus for measuring the thickness of thin film according to claim 12, wherein said detecting means detects light in the wavelength band of 400 - 800 nm.

14. The apparatus for measuring the thickness of thin film according to claim 12, further comprising measurement point determining means for determining measurement points using spectral data for the reflected light detected by said detecting means.

15. The apparatus for measuring film thickness according to claim 14, wherein said measurement point determining means determines measurement points using information relating to the position and size indicating the maximum value or minimum value of the spectral data of said reflected light.

16. The apparatus for measuring film thickness according to claim 14, wherein said measurement point determining means performs frequency analysis of the spectral waveform data of said reflected light and determines measurement points having desired conditions on the basis of the results of said

frequency analysis.

17. The apparatus for measuring film thickness according to claim 14, wherein said measurement point determining means determines the surface area ratio in the measurement field of view of the structure being measured from the spectral data of said reflected light and determines measurement points using the surface area ratio information thus determined.

18. An apparatus for measuring the thickness of thin film, comprising:

irradiating means for irradiating light onto a sample having an optically transparent thin film formed onto the surface thereof;

detecting means for detecting the reflected light generated by said sample due to the irradiation of said light by said irradiating means, by means of an optical system; and

film thickness calculating means for calculating the film thickness from the data detected by said detecting means;

wherein said film thickness calculating means establishes a regional model comprising a plurality of layer structures calculates the waveform of the reflected light from said regional model, and determines the thickness of said optically transparent film by fitting, using the waveform information thus calculated and the spectral waveform information of the detected reflected light.

19. The apparatus for measuring the thickness of thin film according to claim 18, wherein said detecting means

detects light in wavelength band of 400 - 800 nm.

20. The apparatus for measuring the thickness of thin film according to claim 18, further comprising measurement point determining means for determining measurement points using spectral data for the reflected light detected by said detecting means.

21. The apparatus for measuring film thickness according to claim 20, wherein said measurement point determining means determines measurement points using information relating to the position and size indicating the maximum value or minimum value of the spectral data of said reflected light.

22. The apparatus for measuring film thickness according to claim 20, wherein said measurement point determining means performs frequency analysis of the spectral waveform data of said reflected light and determines measurement points having desired conditions on the basis of the results of said frequency analysis.

23. The apparatus for measuring film thickness according to claim 20, wherein said measurement point determining means determines the surface area ratio in the measurement field of view of the structure being measured from the spectral data of said reflected light and determines measurement points using the surface area ratio information thus determined.

24. A method for measuring film thickness comprising the steps of:

irradiating light onto a particular chip of a

plurality of chips on a wafer formed with a plurality of chips whereon a circuit pattern and an optically transparent thin film for covering said circuit pattern are formed respectively;

detecting the light reflected by the particular chip region of said wafer due to said irradiated light;

determining measurement points for measuring the film thickness of said optically transparent thin film on said wafer by using information for the spectral waveform data of the reflected light thus detected; and

measuring the film thickness of said optically transparent thin film at said measurement points, by successively irradiating light onto the measurement points thus determined.

25. The method for measuring film thickness according to claim 24, wherein, in said step of determining said measurement points, measurement points are determined by using information obtained by frequency analysis of the spectral waveform data of the reflected light thus detected.

26. The method for measuring film thickness according to claim 25, wherein the measurement points are determined by using information for the high-frequency component intensity and the low-frequency component intensity obtained by frequency analysis of the spectral waveform data of the reflected light thus detected.

27. The method for measuring film thickness according to

claim 24, wherein, in said step of determining said measurement points, the measurement points are determined by using information for the waveform periodicity of the spectral waveform data of the reflected light thus detected.

28. The method for measuring film thickness according to claim 24, wherein, in said step of determining said measurement points, the measurement points are determined by using information obtained by fitting the spectral waveform data of the reflected light thus detected with logical waveform data.

29. A method for fabricating semiconductor devices, comprising:

a film forming step for forming thin film on a substrate;

a CMP step for processing the thin film formed on said substrate;

an exposure step for coating resist onto said thin film thus processed and exposing a pattern thereon to light;

an etching step for etching said CMP processed thin film, using said exposed resist as a mask; and

a step for irradiating light onto the substrate having undergone said film forming step or the substrate having undergone said CMP step, detecting the reflected light from said substrate generated by said irradiation, obtaining spectral data for said reflected light, and measuring the thickness of the thin film on the substrate using the spectral

data, to an accuracy of 10 nm or less;

wherein the process conditions of at least one process of said film forming step, CMP step, exposure step and etching step is controlled using the results measured in said measuring step.

30. The method of manufacturing a semiconductor device according to claim 29, wherein, in the step of measuring the thickness of said thin film, regional models comprising a plurality of layer structures are established, the waveform of the reflected light from said regional models is calculated, and the thickness of said optically transparent film is determined by fitting, using the waveform information thus determined and the spectral waveform information of the detected reflected light.

31. The method of manufacturing semiconductor devices according to claim 30, wherein said regional models include regional models in which reflected light from said pattern and reflected light from the layer beneath said pattern are mixed.

32. The method of manufacturing semiconductor devices according to claim 29, wherein the regions where the respective structures border each other are established as separate structures in the regional models comprising said plurality of layer structures.

33. A method for manufacturing semiconductor devices, comprising:

a film forming step for forming thin film on a

substrate;

a CMP step for processing the thin film formed on said substrate;

an exposure step for coating resist onto said thin film thus processed and exposing a pattern thereon to light;

an etching step for etching said CMP processed thin film, using said exposed resist as a mask;

a step for irradiating light onto the substrate having undergone said film forming step or the substrate having undergone said CMP step, detecting the reflected light from said substrate generated by said irradiation, obtaining spectral data for said reflected light, determining measurement points using this spectral data, and measuring the thickness of the thin film at each of the measurement points thus determined; and

a step for measuring the thickness of the thin film on the substrate having undergone said film forming step or the substrate having undergone said CMP step, at each measurement point determined using the spectral data of said reflected light as obtained by detecting the reflected light of the light irradiated onto said substrate;

wherein the process conditions of at least one process of said film forming step, CMP step, exposure step or etching step is controlled using the results measured in said measuring step.

34. The method for manufacturing semiconductor devices

according to claim 33, wherein, in the step of measuring the thickness of said thin film, regional models comprising a plurality of layer structures are established, the waveform of the reflected light from said regional models is calculated, and the thickness of said optically transparent film is determined by fitting, using said calculated waveform information and the spectral waveform information of said detected reflected light.

35. The method of manufacturing semiconductor devices according to claim 33, wherein said regional models include regional models in which reflected light from said pattern and reflected light from the layer beneath said pattern are mixed.

36. The method of manufacturing semiconductor devices according to claim 33, wherein the regions where the respective structures border each other are established as separate structures in the regional models comprising said plurality of layer structures.